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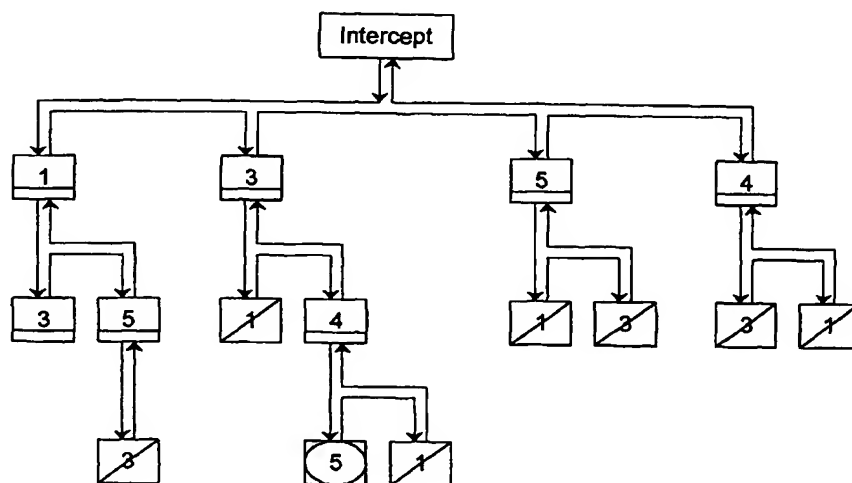
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(54) Title: METHOD FOR MODELLING EXPECTED LIFE OF A PIECE OF EQUIPMENT IN AN INDUSTRIAL PLANT, METHOD AND SYSTEM FOR PERFORMING MAINTENANCE ON AN INDUSTRIAL PLANT



(57) Abstract: Method for determining the probable life of a piece of equipment in an industrial plants which uses multiple regression analysis to express an expected life in terms of variables relevant for the life. And Method for performing maintenance on an industrial plant, whereby operational data and/or design data of the industrial plant is fed into a system, which generates at least one value for an expected life of one piece of equipment of the industrial plant and whereby the piece of equipment is exchanged when the actual life equates to the predicted life or a value derived from the predicted life, whereby- the system uses a formula of the type used in multiple regression analysis, expressing the expected life in terms of variables relevant for the life using factors of influence and the factors of influence are found by performing a multiple regression analysis using data collected for variables relevant for the life and the according life.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/09460

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06F17/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, IBM-TDB, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	F.L. GREITZER ET AL: "Development of a Framework for Predicting Life of Mechanical Systems: Life Extension Analysis and Prognostics (LEAP)" INTERNATIONAL SOCIETY OF LOGISTIS 1999 SYMPOSIUM, 30 August 1999 (1999-08-30) - 2 September 1999 (1999-09-02), pages 1-7, XP002226152 LAS VEGAS, NEVADA, USA	1-3,11
Y	page 4, line 5 -page 6, column 13	6,7,9,10
A	page 1, line 24 -page 3, line 24 --- -/-	4,5

☒ Further documents are listed in the continuation of box C.

☐ Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NAZZAL D ET AL: "Evaluation of the effectiveness of group screening methods as compared to no group screening" SIMULATION CONFERENCE, 2000. PROCEEDINGS. WINTER ORLANDO, FL, USA 10-13 DEC. 2000, PISCATAWAY, NJ, USA, IEEE, US, 10 December 2000 (2000-12-10), pages 1499-1504, XP010529703 ISBN: 0-7803-6579-8 page 1500, right-hand column, line 25 -page 1501, right-hand column, line 5	1-3,11
A	page 1499, left-hand column, line 1 -page 1500, left-hand column, line 34 ---	4,5
X	"Reliability Prediction of Board-Mounted Power Modules" TYCO/ELECTRONICS TECHNICAL NOTE, 'Online! July 1997 (1997-07), pages 1-6, XP002226153 Retrieved from the Internet: <URL:http://power.tycoelectronics.com> 'retrieved on 2002-12-30! page 3, line 7 - line 37 page 2, line 1 - line 22 ---	1,2,11
A	---	3-5
X	LUKE S R ET AL: "Time meter estimation technique for naval equipment" RELIABILITY AND MAINTAINABILITY SYMPOSIUM, 1993. PROCEEDINGS., ANNUAL ATLANTA, GA, USA 26-28 JAN. 1993, NEW YORK, NY, USA, IEEE, US, 26 January 1993 (1993-01-26), pages 10-15, XP010110204 ISBN: 0-7803-0943-X	1,2,11
A	page 11, left-hand column, line 28 -page 12, right-hand column, line 3 ---	3-5
	-/-	

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 03/09460

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>METTAS A ET AL: "System reliability analysis: the advantages of using analytical methods to analyze non-repairable systems"</p> <p>2001 PROCEEDINGS OF THE ANNUAL RELIABILITY AND MAINTAINABILITY SYMPOSIUM. THE INTERNATIONAL SYMPOSIUM ON PRODUCT QUALITY AND INTEGRITY. RAMS. PHILADELPHIA, PA, JAN. 22 - 25, 2001, ANNUAL RELIABILITY AND MAINTAINABILITY SYMPOSIUM, NEW YORK, NY: IEEE, ,</p> <p>22 January 2001 (2001-01-22), pages 80-85, XP010531040</p> <p>ISBN: 0-7803-6615-8</p> <p>page 80, left-hand column, line 1 - line 24</p> <p>page 80, left-hand column, line 26 -page 81, left-hand column, line 29</p> <p>page 81, right-hand column, line 1 -page 82, left-hand column, line 17</p> <p style="text-align: center;">---</p>	6,7,9,10
A	<p>METTAS A: "Reliability allocation and optimization for complex systems"</p> <p>RELIABILITY AND MAINTAINABILITY SYMPOSIUM, 2000. ANNUAL LOS ANGELES, CA, USA 24-27 JAN. 2000, PISCATAWAY, NJ, USA,IEEE, US,</p> <p>24 January 2000 (2000-01-24), pages 216-221, XP010367871</p> <p>ISBN: 0-7803-5848-1</p> <p>page 216, left-hand column, line 28 -page 217, left-hand column, line 17</p> <p>page 217, right-hand column, line 7 -page 218, left-hand column, line 26</p> <p>page 218, right-hand column, line 12 -page 219, left-hand column, line 16</p> <p>page 219, left-hand column, line 24 -page 221, left-hand column, line 33</p> <p style="text-align: center;">---</p>	6,7,9,10
A	<p>METTAS A ET AL: "Modeling & Analysis for Multiple Stress-Type Accelerated Life Data"</p> <p>2002 PROCEEDINGS OF THE ANNUAL RELIABILITY AND MAINTAINABILITY SYMPOSIUM. THE INTERNATIONAL SYMPOSIUM ON PRODUCT QUALITY AND INTEGRITY. RAMS. SEATTLE, WA, JAN. 28 - 31, 2002, ANNUAL RELIABILITY AND MAINTAINABILITY SYMPOSIUM, NEW YORK, NY: IEEE, US,</p> <p>28 January 2002 (2002-01-28), pages 343-348, XP010575849</p> <p>ISBN: 0-7803-7348-0</p> <p>page 344, left-hand column, line 15 -page 346, left-hand column, line 21</p> <p style="text-align: center;">---</p> <p style="text-align: center;">-/--</p>	6,7,9,10

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/09460

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>Y.Z. FRIEDMAN: "Advanced Control of Ethylene Plants - What works, What doesn't and Why"</p> <p>HYDROCARBON ASIA JULY/AUGUST 1999, July 1999 (1999-07), pages 1-14, XP002247259</p> <p>page 5, line 29 -page 6, line 12</p> <p>page 7, line 10 - line 15</p> <p>page 8, line 1 -page 9, line 5</p> <p>page 12, line 11 -page 13, line 33</p> <p>-----</p>	6,7,9,10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 03/09460

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 8, 11
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-5, part of claim 11

Method to determine the probable life of a piece of equipment in an industrial plant using multiple regression analysis to determine expected life of said piece.

2. Claims: 6-10, part of claim 11

Method for performing maintenance of an industrial plant, whereby operational data and design data of the industrial plant are fed into a system generating at least one value for an expected life of one piece of equipment of the industrial plant and whereby the piece of equipment is replaced when the actual life equates to the predicted life or a value derived from the predicted life.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 8, 11

With regard to present claim 8 the following comments are submitted. Present claim 8 relates to an extremely large number of possible methods. In fact, the claim contains so many options and possible permutations that a lack of clarity and conciseness within the meaning of Article 6 PCT arises to such an extent as to render a meaningful search of the claim impossible.

With regard to present claim 11 the following comments are submitted. The wording "Use of the method" used in the present text of claim 11 is vague and unclear and does not allow to determine the category of the claim which is against the provisions of clarity as set out in Article 6 PCT. This International Searching Authority has interpreted the wording of claim 11 as directed to a method of maintaining an ethylene production plant, therefore as a method claim. However, also when considering the above comments, in the view of this International Searching Authority present claim 11 relates to an extremely large number of possible methods. In fact, the claim contains so many options and possible permutations that a lack of clarity and conciseness within the meaning of Article 6 PCT arises to such an extent as to render a meaningful search of the claim impossible.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.